Rockwell Automation Application Content

Device Libraries

Reference Manual

PowerMonitor: PM5000, PM1000 and PM500
Device Object Library

raC_Dvc_PowerMonitor
V1.0

Important User Information

Solid-state equipment has operational characteristics differing from those of electromechanical equipment. Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls (publication SGI-1.1 available from your local Rockwell Automation sales office or online at http://literature.rockwellautomation.com) describes some important differences between solid-state equipment and hard-wired electromechanical devices. Because of this difference, and because of the wide variety of uses for solid-state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

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WARNING	Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.
ATTENTION	Identifies information about practices or circumstances or death, property damage, or economic loss. Attentions avoid a hazard, and recognize the consequence.
SHOCK HAZARD	Labels may be on or inside the equipment, that dangerous voltage may be present.
BURN HAZARD	Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.

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Table of Contents

Contents

1. Overview 4

1.1 Prerequisites 4

1.1.1 Required Software 4

1.1.2 Required Hardware 4

1.2 Functional Description 4

1.3 Footprint 6

2. Device Object Functional Requirements 7

2.1 Primary Function 7

3. Data Types 7

3.1 raC_UDT_ItfAD_PwrMonitor_Set 7

3.2 raC_UDT_ItfAD_PwrMonitor_Cmd 7

3.3 raC_UDT_ItfAD_PwrMonitor_Sts 7

3.4 raC_UDT_Event 8

3.5 raC_UDT_LookupMember_STR0082 9

3.6 raC_UDT_ControlResource_Message 9

3.7 raC_UDT_EnergyElectricalObject 9

3.8 raC_UDT_EnergyBaseObject 10

4. User Interface 12

4.1 Faceplate Launch Button 12

4.2 Faceplate Navigation 13

4.3 Common Status 14

4.4 Home Screen 15

4.5 Power (PWR) Screen 17

4.6 Voltage, Current, Frequency (VIF) Screen 18

4.7 Phase Angle (PA) Screen 19

4.8 Fault Screen 20

4.8.1 Details Screen 20

4.8.2 Configurable Virtual Alarms in PowerMonitor 500 21

Appendix 23

1. Overview

This document defines the functional requirement of PowerMonitor PM5000, PM1000 and PM500 device Objects.

These Preconfigured PowerMonitor Device Object include an Add-On Instruction Rung and HMI Faceplate providing:

- Detailed calculations of Voltage, Current, Power, Energy and Frequency
- Text based status and diagnostics
- Common Control Interfaces maximizing Flexible Device Selection & Application Code Reuse

1.1 Prerequisites

1.1.1 Required Software

- Studio5000 Logix Designer v30.01.00 or later for PAC Application Development
- Studio5000 View Designer v5.02 or later for PanelView 5000 Application Development
- FactoryTalk View ME version 10.00 or later
- FactoryTalk View SE v10.00.00 or later

1.1.2 Required Hardware

At minimum, you will need the following hardware in order to test these faceplates:

- PowerMonitor PM5000 with V4.010 or later firmware
- PowerMonitor PM1000 with V4.019 or later firmware
- PowerMonitor PM500 with V5.001 or later firmware
- PanelView Plus with V10 or later firmware
- ControlLogix 5580 or ControlLogix 5570 controller or with V30.011 or later firmware

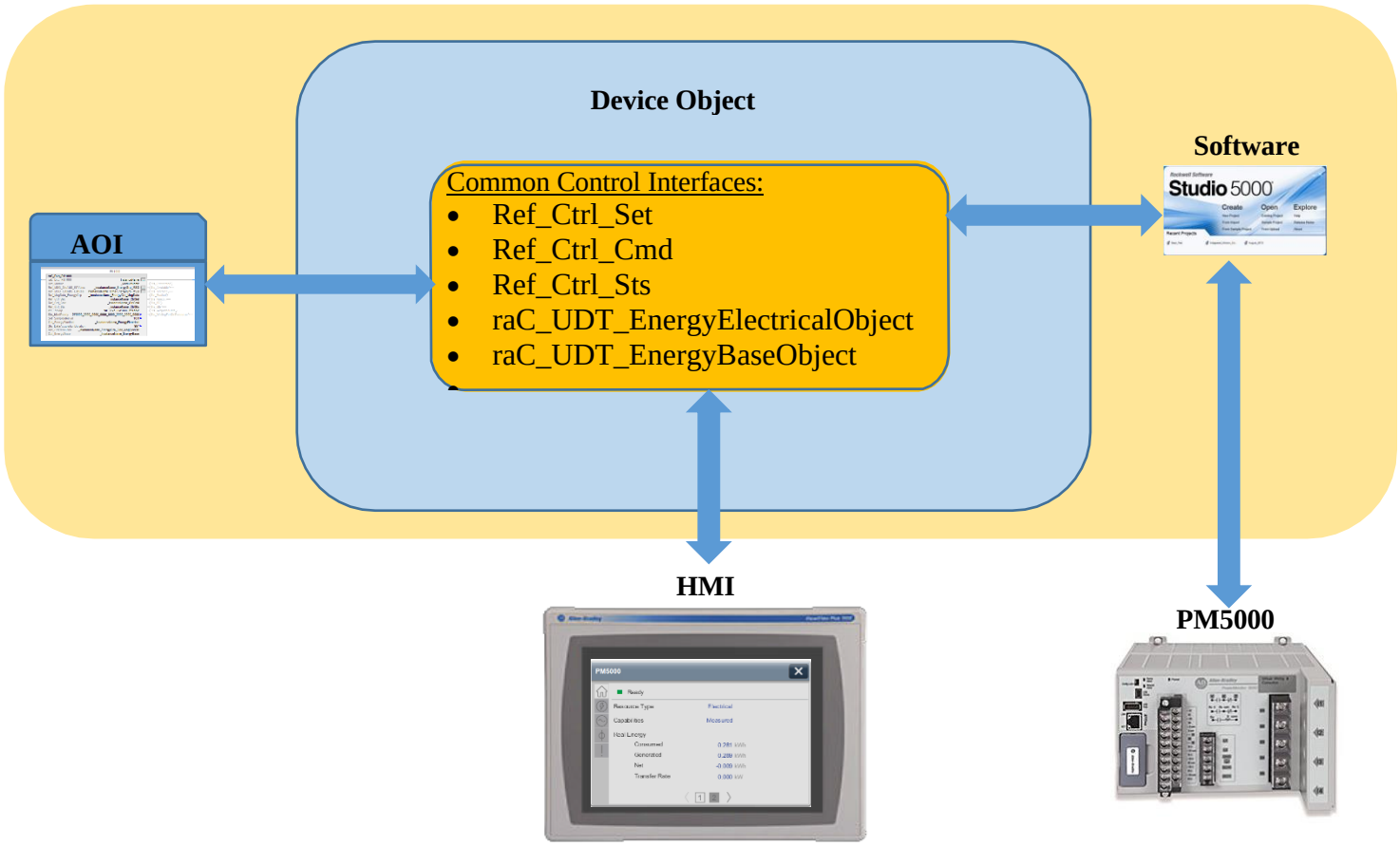
1.2 Functional Description

The PowerMonitor is a compact, cost-effective, electric power, and energy metering device intended for use in industrial control applications, such as distribution centers, industrial control panels, and motor control centers. It measures Voltage and Current in an electrical circuit, meeting revenue accuracy standards. The PowerMonitor converts instantaneous Voltage and Current values to digital values and uses the resulting digital values in calculations of Voltage, Current, power, and energy.

Device Object provides:

- Collect, Process and Deliver Data between Smart Devices and Application Logic
- Provide Device Status & Diagnostics Faceplates for Machine Startup, Commissioning, Operations, and Maintenance
- Include Common HMI Faceplate Components, Device States, and Control Interfaces providing Application Development and Operation Efficiency

All these features provide quick feedback, shorten recovery time, and simplify implementation.


Device Object
Common Control Interfaces:
Ref_Ctrl_Set
Ref_Ctrl_Cmd
Ref_Ctrl_Sts
raC_UDT_EnergyElectricalObject
raC_UDT_EnergyBaseObject
AOI
Software
Studio 5000
HMI
PM5000

1.3 Footprint

Characteristic	Description	Value	Unit
PM5000			
Definition	Estimated memory required to store the object definition, including all dependents (including 1 Instance).	**69.08**	kB
Instance	Estimated memory required per object instantiated.	**7.524**	kB
Execution L85	Estimated execution time / scan footprint evaluated in 1756-L85 PAC	**95**	us
PM1000			
Definition	Estimated memory required to store the object definition, including all dependents (including 1 Instance).	**50.704**	kB
Instance	Estimated memory required per object instantiated.	**1.861**	kB
Execution L85	Estimated execution time / scan footprint evaluated in 1756-L85 PAC	**91**	us
PM500			
Definition	Estimated memory required to store the object definition, including all dependents (including 1 Instance).	**43.224**	kB
Instance	Estimated memory required per object instantiated.	**6.169**	kB
Execution L85	Estimated execution time / scan footprint evaluated in 1756-L85 PAC	**87**	us

2. Device Object Functional Requirements

2.1 Primary Function

PowerMonitor Device Object enables the user to monitor the following functions:

- Overall status of Voltage, Current, Power, Energy and Frequency
- Fault and diagnostics for troubleshooting a PowerMonitor devices

3. Data Types

The following PowerMonitor Common Control Interface tags are the primary device program tags to read and write to when interfacing to PowerMonitor devices.

The PowerMonitor Device Library may be downloaded from the Product Compatibility and Download Center. Search for PowerMonitor Device Library.
https://compatibility.rockwellautomation.com/Pages/home.aspx

3.1 raC_UDT_ItfAD_PwrMonitor_Set

Reserved for future use (for PowerMonitors).

Member	Description	Data Type
InhibitCmd	1 = Inhibit user Commands from external sources; 0 = AllowControl	BOOL
InhibitSet	1 = Inhibit user Settings from external sources; 0 = Allow	BOOL
InhibitCfg	1=Inhibit user Configuration from external sources. 0=Allow	BOOL

3.2 raC_UDT_ItfAD_PwrMonitor_Cmd

Reserved for future use (for PowerMonitors).

Member	Description	Data Type
bCmd	Commands (Bit Overlay)	INT
Physical	Operate as a physical device	BOOL
Virtual	Operate as a virtual device	BOOL

3.3 raC_UDT_ItfAD_PwrMonitor_Sts

This is PowerMonitor common Control Interface User-Defined Data Type for device status. Its members provide application program access to device states, status, and diagnostic data. The table below shows member names, descriptions, and tag data types.

Input	Description	Data Type
eState	Enumerated state value of the device object. 0=Unused 1=Initializing 2=Disconnected 3=Connecting, 4=Disconnecting, 5= Connected, 6=Configuring, 7=Available	DINT

Input	Description	Data Type
eState	Enumerated state value of the device object. 01 = Initializing 02 = Disconnected 03 = Connecting 04 = Disconnecting 05 = Connected 06 = Configuring 07 = Available	DINT
FirstWarning	First Warning Event Data	
FirstFault	First Fault Event Data	
eCmdFail	Enumerated command failure code (Not used in sensors as there is no physical/virtual mode) 0 = Interface Initialization failure code 1 = Operate as Physical Device failure code. 2 = Operate as Virtual Device failure code	DINT
bSts	Bit overlay (Visible) covering all subsequent Boolean members.	DINT
Physical	1=Operating as a physical device	BOOL
Virtual	1=Operating as a virtual device [Not an output device]	BOOL
Connected	Connected Status	BOOL
Available	The device is available for interaction with the user program in the PAC	BOOL
Warning	A warning is active on the device	BOOL
Faulted	A fault is active on the device	BOOL
Ready	1=Device is active	BOOL
Active	1=Device is active	BOOL

Note: Members – Physical & Virtual are not used in any PowerMonitor AOI it will be done in future release.

3.4 raC_UDT_Event

Member	Description	Data Type
Type	1 = Status 2 = Warning 3 = Fault 4 ...n = User	DINT
ID	User definable event ID	DINT
Category	User definable category (Electrical, Mechanical, Materials, Utility, etc.)	DINT
Action	User definable event action code	DINT
Value	User definable event value or fault code	DINT
Message	Event message text	STRING
EventTime_L	Timestamp	LINT
EventTime_D	Timestamp (Y, M, D, h, m, s, us)	DINT[7]

3.5 raC_UDT_LookupMember_STR0082

Member	Description	Data Type
Code	Stores the value of device fault code.	DINT
Desc	Stores the Messages related to fault code.	STRING

3.6 raC_UDT_ControlResource_Message

Member	Description	Data Type
ResourceInUse	Resource in Use	BOOL
SampleInterval	Sample Interval is adjustable as per user requirement	REAL

3.7 raC_UDT_EnergyElectricalObject

Member	Description	Data Type
RealEnergyConsumedOdo	Total real energy consumed.	INT[5]
RealEnergyGeneratedOdo	Total real energy generated.	INT[5]
RealEnergyNetOdo	Total Real energy	INT[5]
ReactiveEnergyConsumedOdo	Total Reactive energy consumed.	INT[5]
ReactiveEnergyGeneratedOdo	Total Reactive energy generated.	INT[5]
ReactiveEnergyNetOdo	Total Reactive energy.	INT[5]
ApparentEnergyOdo	Total Apparent energy.	INT[5]
KiloampereHours	Kiloampere-Hours Odometer	INT[5]
LineFrequency	Last Frequency reading.	REAL
CurrentL1	Phase 1 scaled RMS Current	REAL
CurrentL2	Phase 2 scaled RMS Current	REAL
CurrentL3	Phase 3 scaled RMS Current	REAL
AverageCurrent	Average RMS Current	REAL
CurrentPercentUnbalanced	Percent maximum deviation from Ave. / Ave.	REAL
VoltageL1N	Phase 1 scaled RMS Voltage	REAL
VoltageL2N	Phase 2 scaled RMS Voltage	REAL
VoltageL3N	Phase 3 scaled RMS Voltage	REAL
VoltageAverageLN	Averaged RMS Voltage	REAL
VoltageL1L2	Line 1 to Line 2 Volts	REAL
VoltageL2L3	Line 2 to Line 3 Volts	REAL
VoltageL3L1	Line 3 to Line 1 Volts	REAL
VoltageAverageLL	Average Line to Line Volts	REAL
VoltagePercentUnbalanced	Percent Maximum deviation from Ave. / Ave.	REAL
RealPowerL1	Line 1 kW	REAL
RealPowerL2	Line 2 kW	REAL
RealPowerL3	Line 3 kW	REAL
RealPowerTotal	Total kW	REAL

Member	Description	Data Type
ReactivePowerL1	Line 1 kVAR	REAL
ReactivePowerL2	Line 2 kVAR	REAL
ReactivePowerL3	Line 3 kVAR	REAL
ReactivePowerTotal	Total kVAR	REAL
ApparentPowerL1	Line 1 kVA	REAL
ApparentPowerL2	Line 2 kVA	REAL
ApparentPowerL3	Line 3 kVA	REAL
ApparentPowerTotal	Total kVA	REAL
TruePowerFactorL1	Percent ratio between power and apparent power.	REAL
TruePowerFactorL2	Percent ratio between power and apparent power.	REAL
TruePowerFactorL3	Percent ratio between power and apparent power.	REAL
TruePowerFactorThreePhase	Percent ratio between power and apparent power.	REAL
PhaseRotation	0 = None, 1 = ABC, 2 = ACB	DINT

Note:
For PowerMonitor 1000: *KiloampereHours* member is not applicable
For PowerMonitor 500: *PhaseRotation* member is not applicable

3.8 raC_UDT_EnergyBaseObject

Member	Description	Data Type
ResourceType	0 = Generic, 1 = Electrical, 2 = Non-Electrical,	INT
Capabilities	0 = Energy Measured,1 = Energy Derived, 2 = Energy Proxy, 3 = Energy Aggregated, 4 = Energy Rate Fixed	INT
Accuracy	Specifies the accuracy of power and energy metering results.	INT
AccuracyBasis	Basis of the Energy Accuracy Attribute. 0 = Per Cent of Reading, 1 = Per Cent of Full-Scale Reading, 2 = Absolute Error in kW	INT
FullScaleReading	Full Scale Energy Transfer Rate, e.g., Power (kW)	REAL
DataStatus	Status of the Device or Aggregation Data. 0 = No Errors, 1 = Not Metering	INT
ConsumedEnergyOdo	The consumed energy value in kWh. Array Elements: 0 = kWH *10^-3, 1 = kWH, 2 = kWH *10^3, 3 = kWH *10^6, 4 = kWH *10^9	INT[5]

Member	Description	Data Type
GeneratedEnergyOdo	The generated energy value in kWh. Array Elements: 0 = kWH *10^-3, 1 = kWH, 2 = kWH *10^3, 3 = kWH *10^6, 4 = kWH *10^9	INT[5]
TotalEnergyOdo	The total energy value in kWh. Array Elements: 0 = kWH *10^-3, 1 = kWH, 2 = kWH *10^3, 3 = kWH *10^6, 4 = kWH *10^9	INT[5]
EnergyTransferRate	The time rate of energy consumption or production, e.g., power, in kW	REAL

Note:
For PowerMonitor 5000: *AccuracyBasis* member is not applicable
For PowerMonitor 1000: *AccuracyBasis* member is not applicable
For PowerMonitor 500: *ResourceType* member's Default value is 1
Capabilities member's Default value is 0
Accuracy, *AccuracyBasis, Full Scale Reading,* DataStatus members are not applicable

4. User Interface

The faceplate files allow you to quickly load, configure and use preconfigured status and diagnostic displays available for View Designer, FactoryTalk View Site Edition and FactoryTalk View Machine Edition.

In this document, the faceplate pictures (or snapshots) are of View Designer. The faceplate is similar to FactoryTalk View ME and SE, and it can be downloaded from Device Object Library available in Product Compatibility and Download Center.

https://compatibility.rockwellautomation.com/Pages/home.aspx

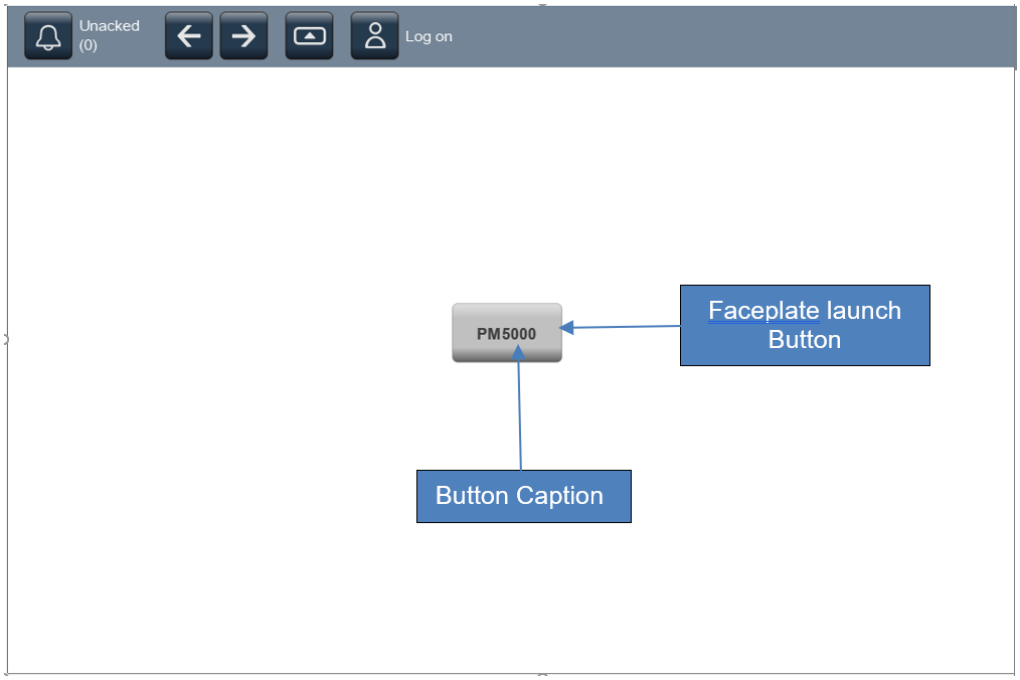
Note:

For further information on faceplate configuration and operation refer to the following videos from PowerMonitor Device Library downloaded files:

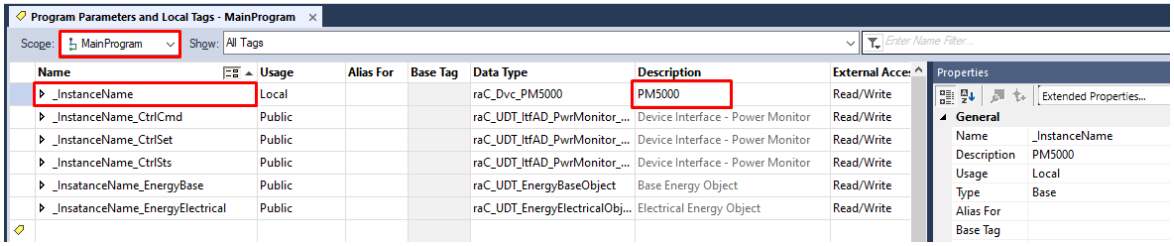
- Operational_Overview_of_Power_Monitor_Object_Faceplates.mp4
- How_To_Import_and_Configure_PowerMonitor_Objects_in_Logix_Designer.mp4
- How_To_Import_and_Configure_PowerMonitor_Objects_in_View_Designer.mp4
- How_To_Import_and_Configure_PowerMonitor_Device_Objects_in_FTViewME.mp4
- How_To_Import_and_Configure_PowerMonitor_Device_Objects_in_FTViewSE.mp4

4.1 Faceplate Launch Button

Launch button available on the startup screen of the View Designer application when pressed, it will launch PowerMonitor device object faceplate with default home screen.



Faceplate's launch button display's button caption and Faceplate Title is linked to "_InstanceName.@description" tag, which is coming from AOI instance and this AOI tag is user configurable.



4.2 Faceplate Navigation

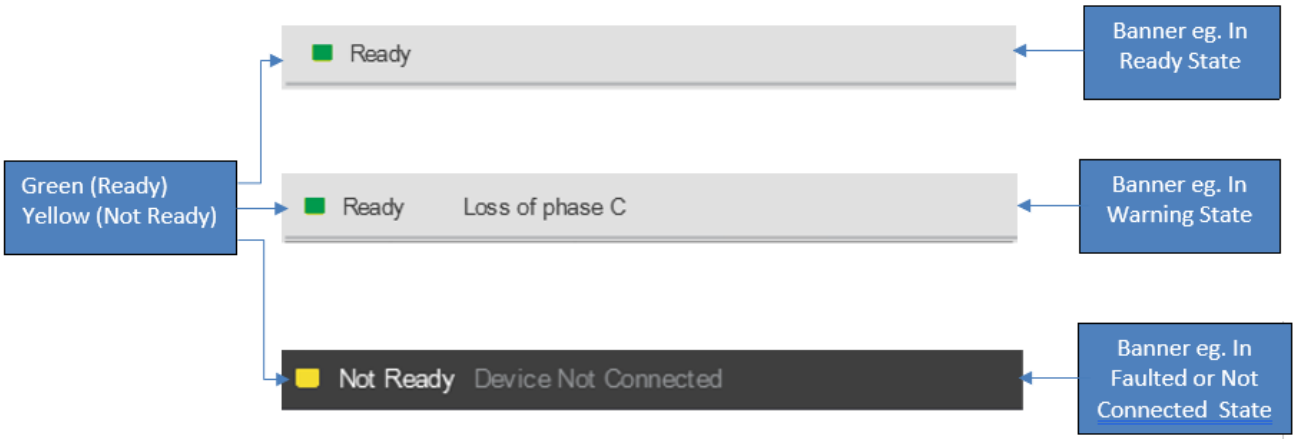
Tab descriptions:

- The **Home** tab provides Resource type, Capabilities and Real Energy related information.
- The **Power** tab provides a power related information.
- The **VIF** tab provides a Voltage, Current and Frequency related information.
- The **Phase Angle** tab provides a Voltage and Current phase angle related information.
- The **Fault** tab displays a running history of the last (4) faults/warnings and alarms with descriptions.

4.3 Common Status

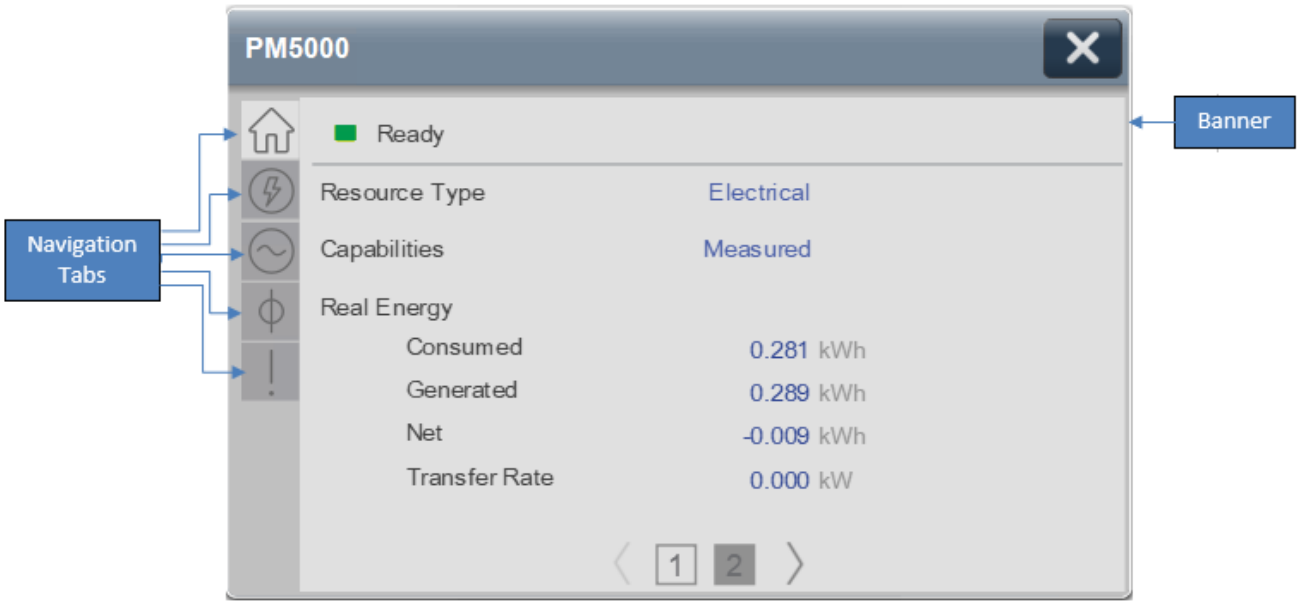
A banner will be displayed at the top of each screen to provide the following information of the device:

1. Ready State
2. Warning State (device will show Ready and warning message)
3. Faulted State (device will show Not Ready and fault message)



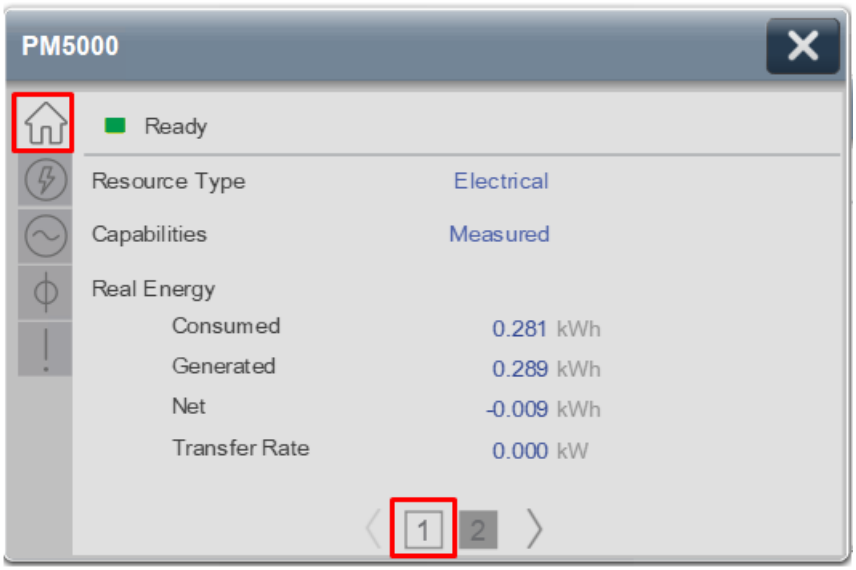
4.4 Home Screen

The Home Screen is visible when the Home tab button is selected in the tab control object on the left side of the screen.

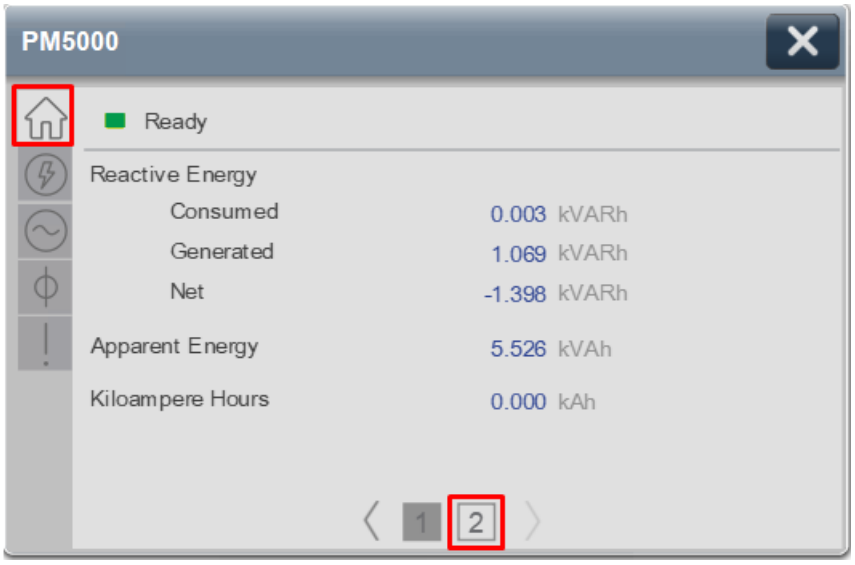


The Home screen is the main screen for the faceplate. The Home Tab Display consist of 2 pages:

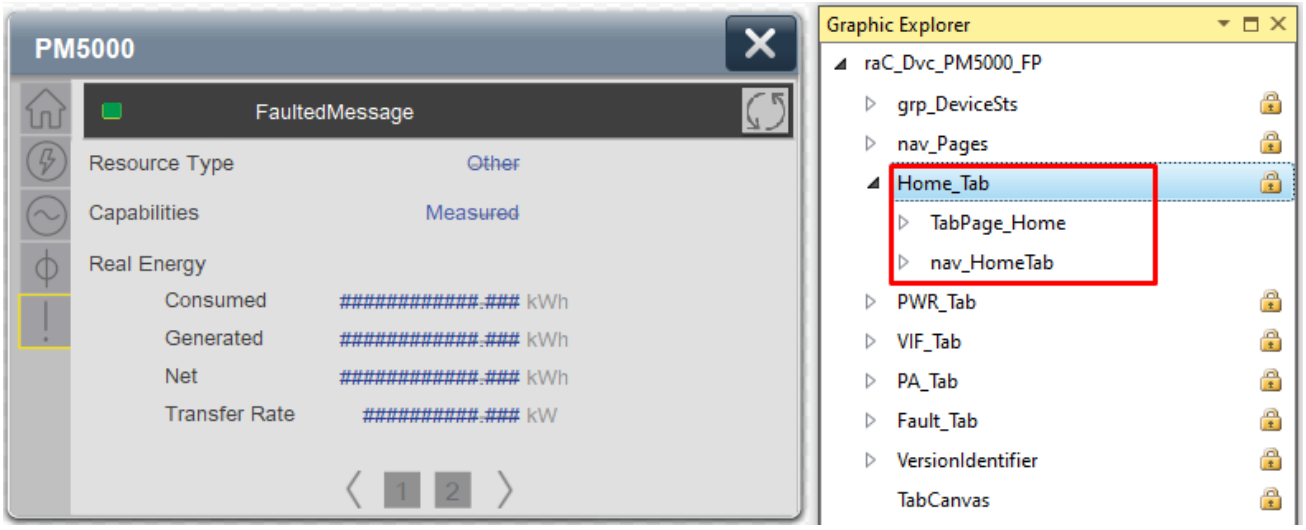
- Page 1 displays the Base energy object parameters like resource type, capabilities, and real energy values in kilowatt hour.



- Whereas page 2 displays the electrical energy object parameters that is Reactive Energy in kilowatt amperes reactive hours and net Apparent energy in kilo volt ampere hours.



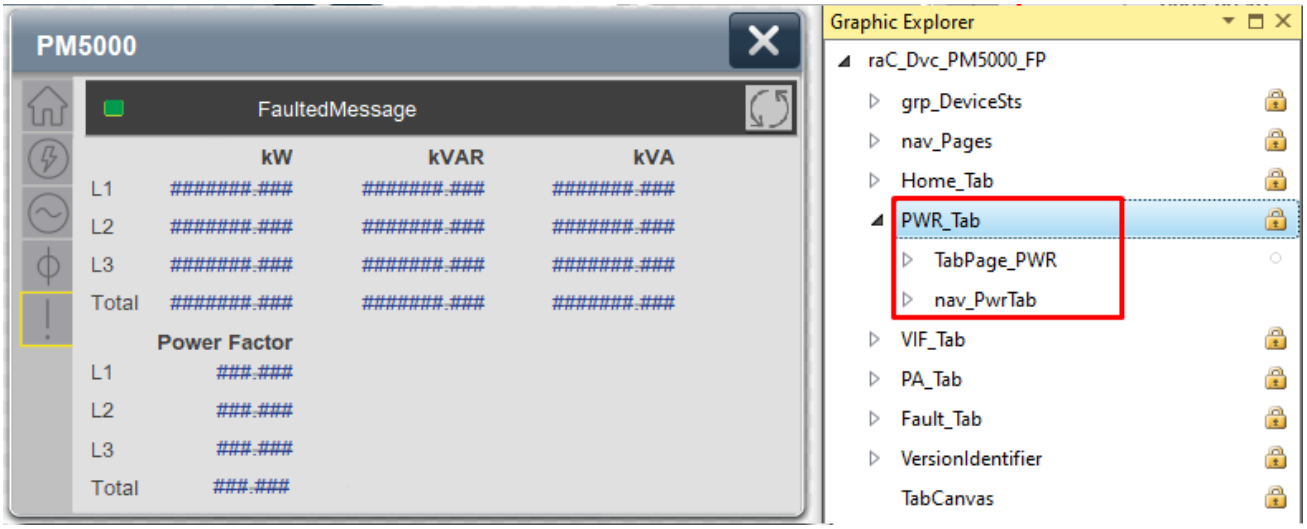
These objects are created with sets of elements grouped into subgroups as shown in below image.



4.5 Power (PWR) Screen

Power Screen provides the power status of the connected device. Real Power, Reactive Power, Apparent Power and Power Factor for individual phase L1, L2, L3 & sum of phases.

These objects are created with sets of elements grouped into subgroups as shown in below image.



4.6 Voltage, Current, Frequency (VIF) Screen

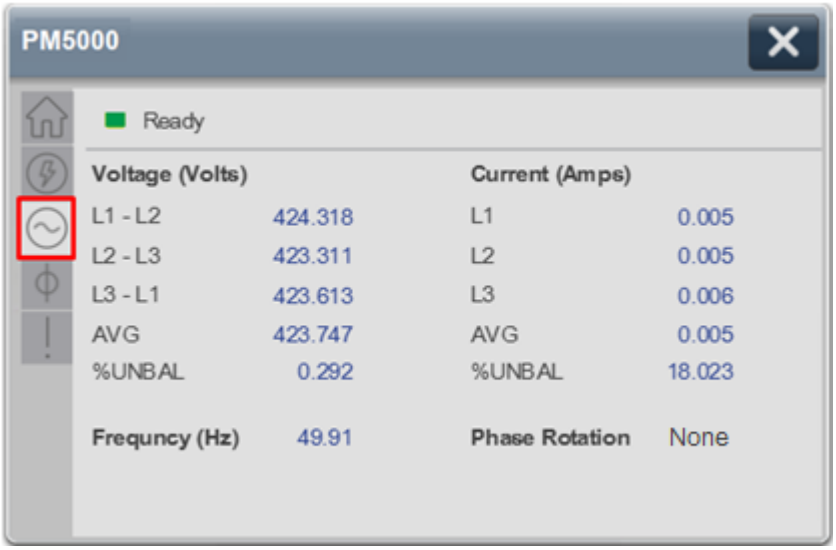
The VIF tab provides a Voltage, Current, Frequency and Phase Rotation related information.

Voltage parameter Displays the RMS line to Line Voltage of individual phase & average of L1-L2, L2-L3, L3-L1 in Volts.

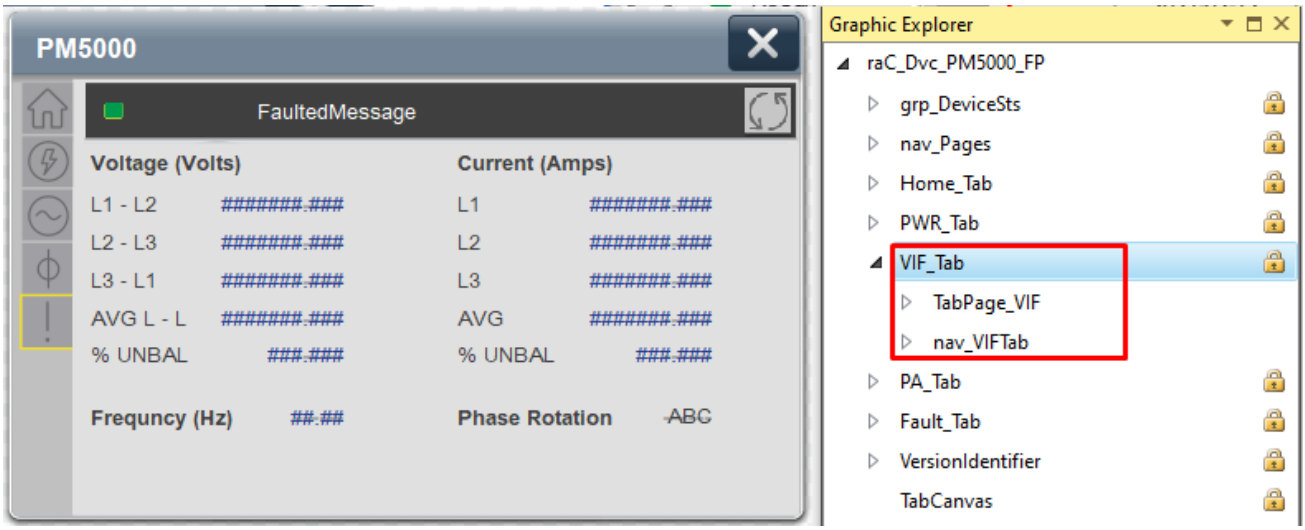
Current parameter Displays the RMS line Current of individual phase & average of L1, L2, L3 in amps.
% Unbalance parameters is the ratio of Negative Sequence by Positive Sequence of Voltage and Current.

Frequency Parameter displays the Frequency of Voltage in Hertz.

Phase rotation can be either clockwise or counterclockwise rotation. which is determined by A-B-C or A-C-B, respectively. If load is not connected it will show as None.



These objects are created with sets of elements grouped into subgroups as shown in below image.

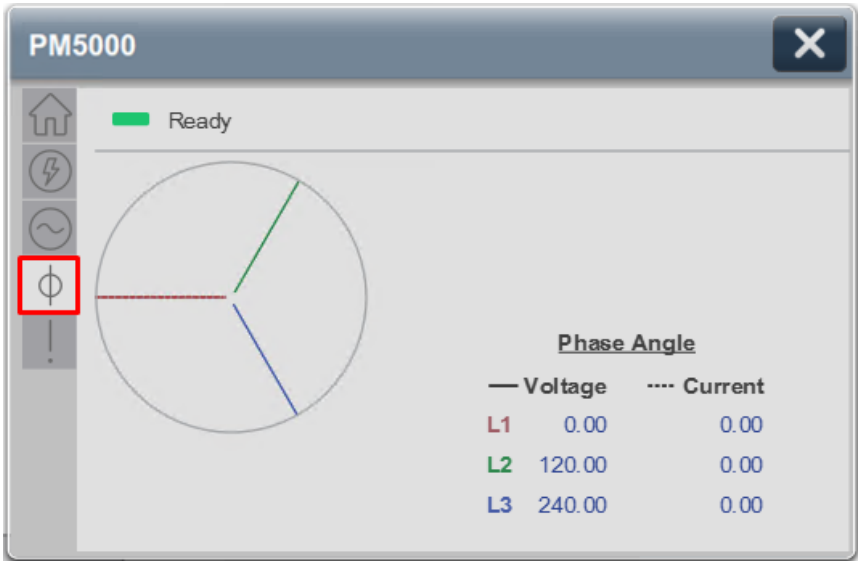


4.7 Phase Angle (PA) Screen

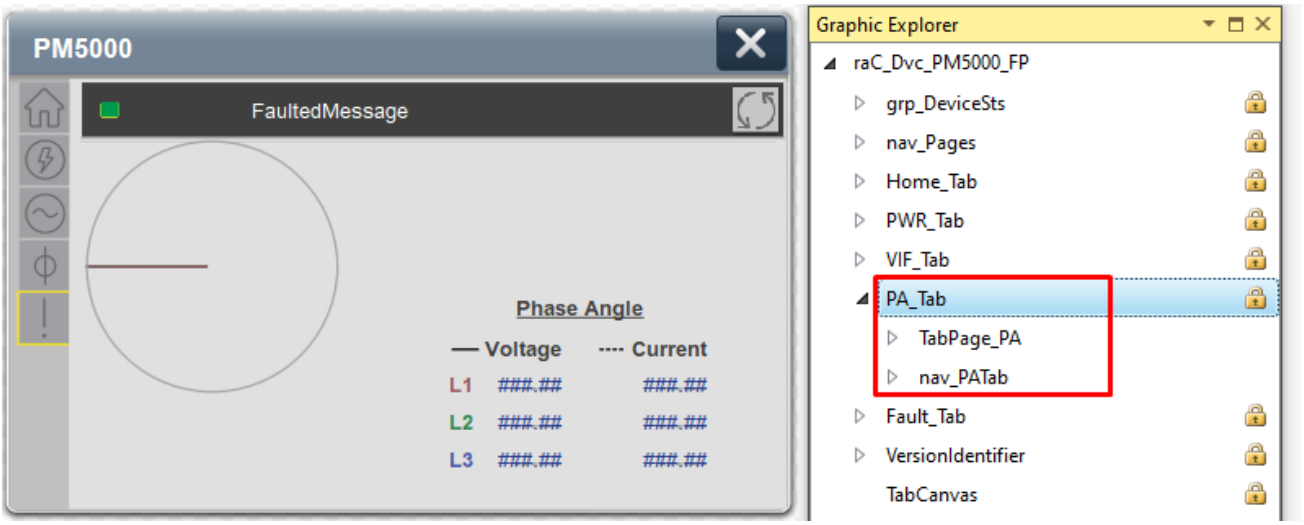
The Phase Angle tab provides Voltage and Current phase angle related information

The Phase angle tab is available in PowerMonitor 5000 and 1000 faceplate but not available in PowerMonitor 500.

The PowerMonitor unit calculates phase angles of Voltage and Current. Which are represented in different colors with respect to individual phase L1, L2 & L3.

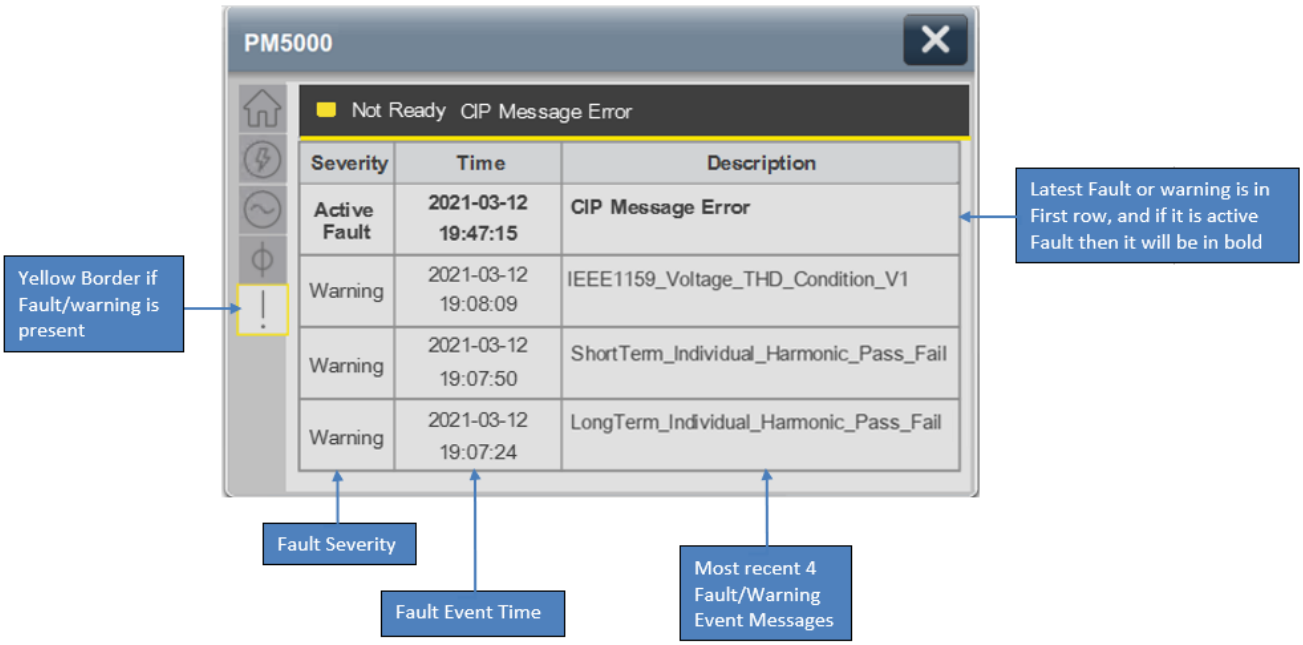


These objects are created with sets of elements grouped into subgroups as shown in below image.



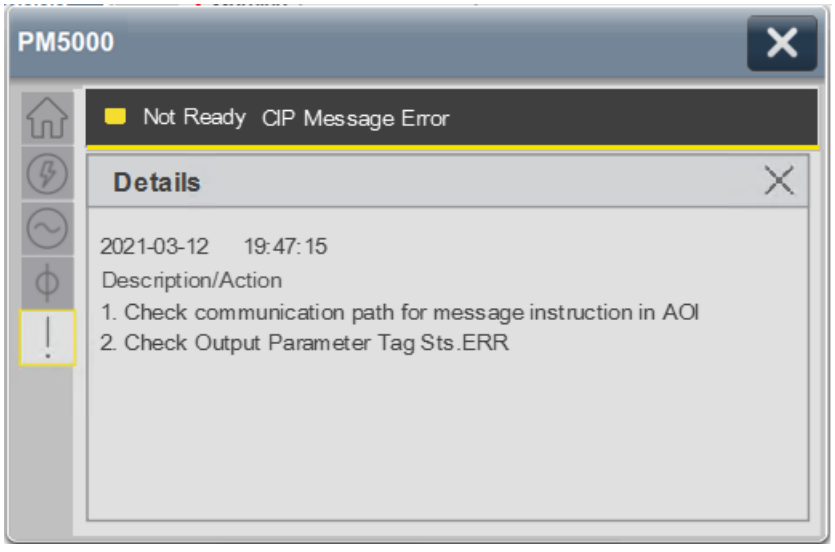
4.8 Fault Screen

The Fault Warning screen displays information for up to four faults/warnings for the device. The fault table displays the Severity level (Fault, Warning or Active Fault), time (and date) and a description of the fault.
Note, only row 1 will display the “Active Fault” in the severity column if there is a Current active fault, else it will display the last fault. Rows 2-4 only display past faults and warnings, not an active fault.



4.8.1 Details Screen

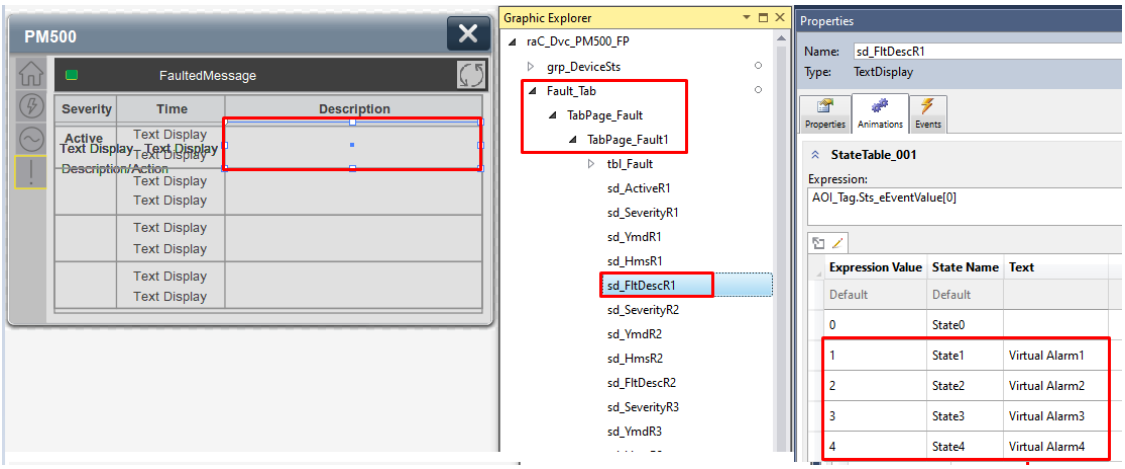
The Details Screen provides a more detailed description and possible action steps to remedy condition.



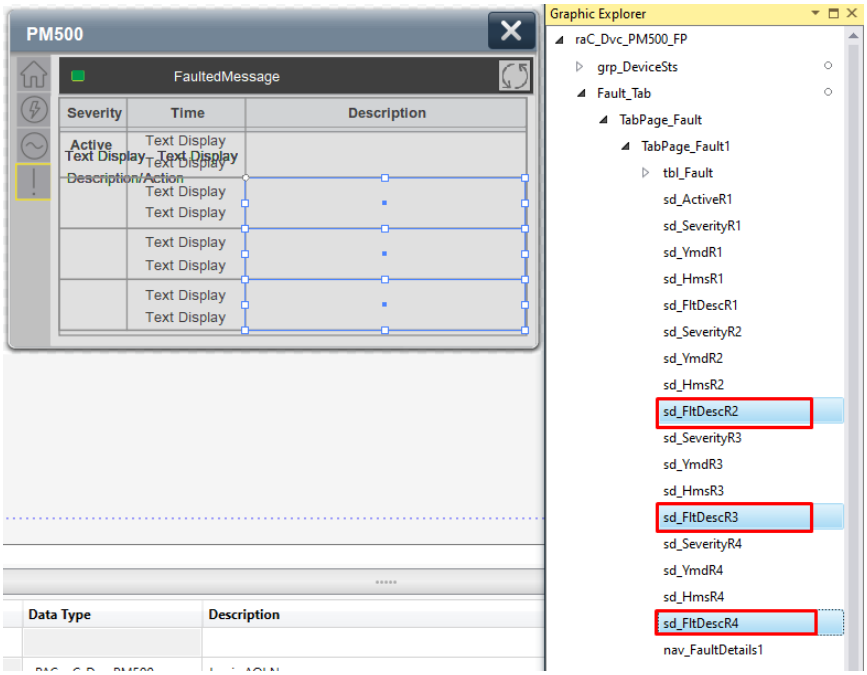
4.8.2 Configurable Virtual Alarms in PowerMonitor 500

For PowerMonitor 500 the following steps needs to be considered for configuring Virtual Alarms.

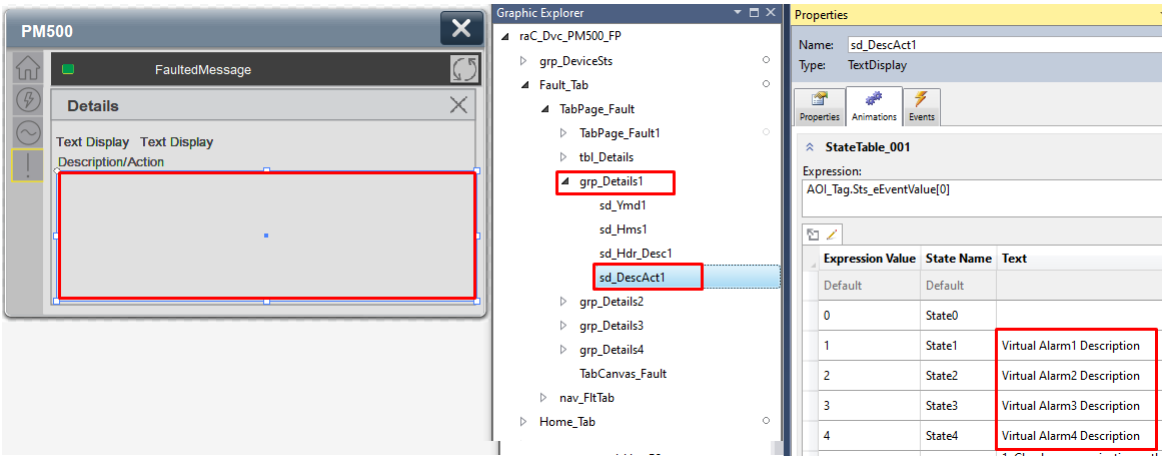
In TabPage_Fault, Expand TabPage_Fault1 in that select sd_FltDescR1, go to its State table and you can configure Virtual Alarm1 to Virtual Alarm4 as per user Alarms.
This configuration is for row 1 of fault table.



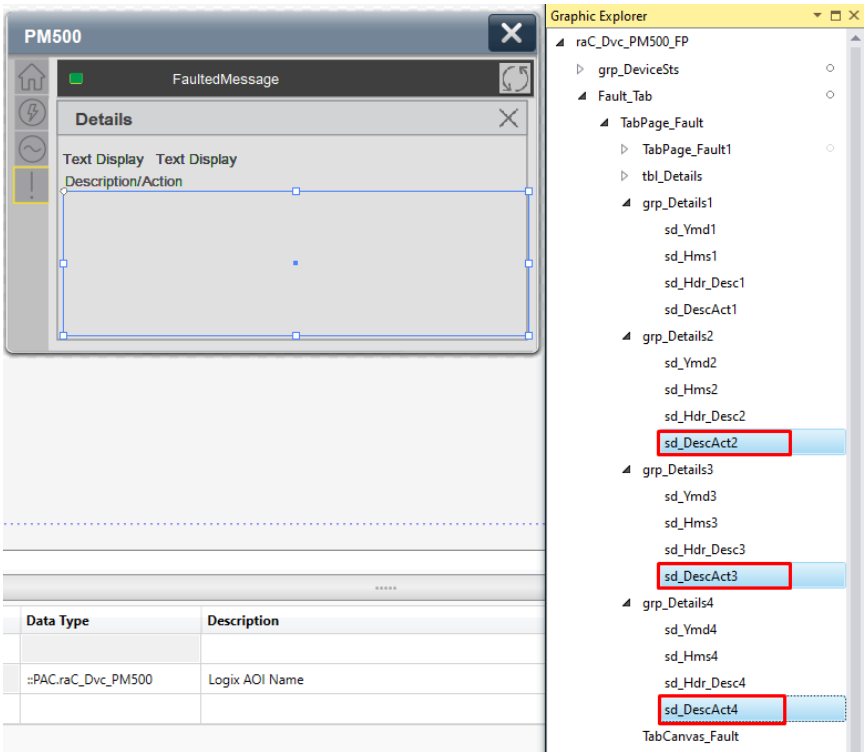
So, Copy the States text and paste it on the sd_FltDescR2, sd_FltDescR3 and sd_FltDescR4 State tables.



For Alarm Description/Action, expand the grp_Details1 and then grp_Details1 and then select sd_DescAct1.
User can configure Virtual Alarm1 Description to Virtual Alarm4 Description as per your Alarm's Description/Action. This configuration is for row 1 fault's Detail screen description.



For Alarm Description/Action configuration for Row 2 to 4, copy the states text and paste it on the sd_DescAct2, sd_DescAct3 and sd_DescAct4 State tables. So, fault Details configuration will get complete for Row 2, Row 3 and Row 4.



Appendix

For More Configuration and Operational Information

Refer to How to & Operational Videos within the PowerMonitor folder within PowerDeviceObjects folder of the Power Device Library downloaded files.

The Power Device Library may be downloaded from the Product Compatibility and Download Center. Search for Power Device Library.

https://compatibility.rockwellautomation.com/Pages/home.aspx

To Provide Feedback or Obtain Additional Information

Contact RASimplification Team at rasimplification@ra.rockwell.com

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